

REMARKS/ARGUMENTS

The Examiner is thanked for the thorough examination and search of the subject.

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Claims 92, 97, 99, 101, 104, 106-109, 118, 120-123, 125-129, 151, 152, 154 and 156-165 are pending; Claims 92, 99, 101, 104, 118, 120, 151 and 161 have been currently amended; Claim 165 has been newly added; Claims 1-91, 93-96, 98, 100, 102, 103, 105, 110-117, 119, 124, 130-150, 153 and 155 have been canceled. No new matter is believed to have been added.

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Response to Specification Rejection

Reconsiderations of Claims 124 and 155 objected to because the claim status identifier is incorrect are respectfully requested as Claims 124 and 155 have been canceled.

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Response to Drawing Rejection

Reconsiderations of the drawings objected to under 37 CFR 1.83(a) are respectfully requested as Claims 92, 120, 151 and 161 have been currently amended.

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Response to Claim Rejections under 35 U.S.C. 112, first paragraph

Reconsiderations of Claims 92, 97, 99, 101, 104, 106-109 and 118 rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement are respectfully requested as independent Claim 92 has been currently amended.

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Response to Claim Rejections under 35 U.S.C. 103

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Applicants respectfully traverse the rejections for at least the reasons set forth below.

5 **Response to Claims 120-123, 125-129, 163 and 165**

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As currently amended, independent Claim 120 is recited below:

10 120. A bonding structure on a chip comprising a pad having a top surface with a first region, a second region and a third region between said first and second regions, and a passivation layer on said first and second regions, wherein an opening in said passivation layer is over said third region, comprising:

15 a metal layer on said third region, over said passivation layer and over said first and second regions, wherein said metal layer is connected to said third region through said opening;

 a copper pillar on said metal layer, over said passivation layer and over said first, second and third regions, wherein said copper pillar is connected to said third region through said metal layer; and

20 a tin-containing cap over said copper pillar, wherein said tin-containing cap is connected to said third region through said copper pillar, wherein said tin-containing cap comprises silver, and wherein said tin-containing cap has a first thickness less than a second thickness of said copper pillar.

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25 *Reconsiderations of Claims 120-123, 126-129 and 163 rejected under 35 U.S.C. 103(a) as being unpatentable over Morrell (U.S. Pat. No. 6,013,571) in view of Ohuchi (U.S. Pub. No. 2002/0033525) and of Claim 125 rejected under 35 U.S.C. 103(a) as being unpatentable over Morrell in view of Ohuchi, further in view of Fang (U.S. Pub. No. 2002/0095784) are requested based on the following remarks.*

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Applicants respectfully assert that the bonding structure currently claimed in Claim 120 patentably distinguishes over the citations by Morrell (U.S. Pat. No.

6,013,571) in view of Ohuchi et al. (U.S. Pub. No. 2002/0033525).

5 The Examiner considers that “Morrell discloses the same invention as claimed except that its tin cap comprises lead instead of silver or copper. Ohuchi (Par. 0044) shows that Sn/Pb and Sn/Ag produce equivalent structures known in the art. Therefore, because these materials are art recognized equivalents at the time the invention was made, one of ordinary skill in the art would have found it obvious to substitute Sn/Ag for Sn/Pb”. Furthermore, Sn/Ag is a known material for providing eutectic solders as exemplified by Ohuchi (Para. 0044). As such, it would have been
10 obvious to one of ordinary skill in the art to select either Sn/Ag as an alternate eutectic solder, since it has been held that the selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination.”
~ See line 16 of page 5 through line 4 of page 6, in the last Office Action mailed May 14, 2008 ~

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Applicants respectfully traverse the Examiner’s opinion because Ohuchi’s solder 2 is believed to be non-analogous to Morrell’s solder cap 30. Morrell teaches that a solder cap 30 is electroplated over a copper pillar 24 in an opening 22 in a photoresist layer 18. ~ See Fig. 1, col. 3, lines 52-67 ~ However, Ohuchi fails to
20 teach, hint or suggest that a solder 2, such as a tin-silver alloy, can be electroplated on a metal pad. ~ See Paragraph [0044] ~ Therefore, even under Morrell’s teaching in view of Ohuchi’s teaching, those skilled in the art would not consider that Ohuchi’s solder 2, such as a tin-silver alloy, can be electroplated over Morrell’s copper pillar 24 because Ohuchi fails to teach, hint or suggest that the solder 2 can be formed by an
25 electroplating process. It is believed that Ohuchi’s solder 2 is non-analogous to Morrell’s solder cap 30.

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Withdrawal of rejection under 35 U.S.C. 103 (c) to Claim 120 is respectfully requested.

For at least the foregoing reasons, applicants respectfully submit independent Claim 120 patently distinguishes over the prior art references, and should be allowed.

For at least the above reasons, dependent Claims 121-123, 125-129, 163 and 165
patently defines over the prior art as well.

Response to Claims 151, 152, 154, 156-162 and 164

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As currently amended, independent Claim 151 is recited below:

151. A bonding structure on a chip comprising a pad having a top surface with a
first region, a second region and a third region between said first and second
10 regions, and a passivation layer on said first and second regions, wherein an
opening in said passivation layer is over said third region, comprising:

a metal layer on said third region, over said passivation layer and over
said first and second regions, wherein said metal layer is connected to said third
region through said opening;

15 a copper pillar on said metal layer, over said passivation layer and over
said first, second and third regions, wherein said copper pillar is connected to
said third region through said metal layer; and

a tin-containing cap over said copper pillar, wherein said tin-containing
cap is connected to said third region through said copper pillar, wherein said
20 tin-containing cap has a first thickness less than a second thickness of said
copper pillar, and wherein said tin-containing cap has a greatest transverse
dimension less than that of said copper pillar.

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25 *Reconsiderations of Claims 151, 152, 154, 157, 159-162 and 164 rejected under*
35 U.S.C. 103(a) as being unpatentable over Morrell (U.S. Pat. No. 6,013,571), of
Claim 156 rejected under 35 U.S.C. 103(a) as being unpatentable over Morrell in
view of Fang (U.S. Pub. No. 2002/0095784) and of Claim 158 rejected under 35
U.S.C. 103(a) as being unpatentable over Morrell in view of Ohuchi (U.S. Pub. No.
30 *2002/0033525) are requested based on the following remarks.*

Applicants respectfully assert that the bonding structure currently claimed in

Claim 151 patentably distinguishes over the citations by Morrell (U.S. Pat. No. 6,013,571).

5 The Examiner considers that “With respect to claim 151 that the cap has a thickness across axis of the body and therefore a traverse dimension less than that of the copper pillar, applicant has not disclosed that the selected dimension is for a particular unobvious purpose, produces an unexpected result, or is otherwise critical. As such, the selected dimension would have been obvious to one of ordinary skill in the art, since it has been held that mere dimensional limitations are prima facie
10 obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical.” ~ *See line 17 of page 8 through line 2 of page 9, in the last Office Action mailed May 14, 2008 ~*

The claimed subject matter that a tin-containing cap has a greatest transverse
15 dimension less than that of a copper pillar under the tin-containing cap, as currently claimed in Claim 151, could have the tin-containing cap easily lower into an opening in an insulating layer to join with a pad exposed by the opening, as taught in Fig. 5B and in paragraph [0044] in the original specification, which is not anticipated by Morrell. The claimed subject matter that a tin-containing cap has a greatest
20 transverse dimension less than that of a copper pillar under the tin-containing cap, as currently claimed in Claim 151 would have not been obvious to one of ordinary skill in the art, since Morrell fails to anticipate the above-mentioned advantage.

Withdrawal of rejection under 35 U.S.C. 103 (c) to Claim 151 is respectfully
25 requested.

For at least the foregoing reasons, applicants respectfully submit independent Claim 151 patently distinguishes over the prior art references, and should be allowed. For at least the above reasons, dependent Claims 152, 154, 156-162 and 164 patently
30 defines over the prior art as well.

CONCLUSION

Some or all of the pending claims are believed to be in condition for allowance. Accordingly, allowance of the claims and the application as a whole are respectfully requested.

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Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

10 Sincerely yours,



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Note: Please leave a message in my voice mail if you need to talk to me. (The time in
20 D.C. is 12 hours behind the Taiwan time, i.e. 9 AM in D.C. = 9 PM in Taiwan.)